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January 1, 1999

Magalie Roman Salas  
Office of the Secretary  
Federal Communications Commission  
1919 M St. NW  
Room 222  
Washington, D.C. 20554

Dear Ms. Salas:

Please find enclosed an original plus four copies of the comments of Vanu G. Bose on the First Report and Order and Third Notice of Proposed Rulemaking, in the Matter of The Development of Operational, Technical and Spectrum Requirements for Meeting Federal, State and Local Public Safety Agency Communication Requirements Through the Year 2010. Establishment of Rules and Requirements for Priority Access Service.

WT Docket No. 96-86

Sincerely,



Vanu G. Bose

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**In the Matter of**

WT Docket No. 96-86

## Establishment of Rules and Requirements For Priority Access Service

### COMMENTS OF VANU G. BOSE

## I. Introduction.

Public safety agency communications can be improved dramatically by ensuring that public safety agencies are able to take advantage of software radio technology. The development of software radio technology will enable seamless interoperation between otherwise incompatible public safety radios in the near future. To take full advantage of this, proprietary protocols (used, for example, for trunking or encryption) must be licensed to the extent necessary to enable interoperation between systems employing any such proprietary protocols (“proprietary systems”) and systems that do not employ proprietary protocols or that employ incompatible proprietary protocols. The

Commission should ensure that public safety agencies seeking to communicate with agencies that use proprietary systems will be able to interoperate by mandating that radio manufacturers license those proprietary protocols for interoperation purposes. This will allow public safety agencies to address interoperability problems effectively and efficiently (as described below) without causing undue hardship on radio manufacturers.<sup>2</sup>

## II. Background.

My interest in the matters addressed by the NPRM is twofold: as a researcher and as an entrepreneur. Over the last four years I have been pursuing my doctoral degree in computer science department at Massachusetts Institute of Technology. The subject of my studies has been software radios. My research in this area was undertaken under the auspices of the SpectrumWare research project at MIT which was funded by the Defense Advanced Research Projects Agency Global Mobile Communications program. The result of this research project was demonstration of the feasibility of performing in software all of the signal processing associated with wireless communications. The system created as part of the SpectrumWare project downconverts a wide band (10-20 MHz) of the RF spectrum, located anywhere from 100 kHz to 2.6GHz, and performs all of the signal processing, including the multiple access functions, in software. By changing only the software, the system has been able to interoperate with many different radios, including cellular telephones, two-way radios, conventional broadcast media and a 2.5GHz wireless LAN employing frequency hopping. Furthermore, the system demonstrated its ability to interoperate with legacy systems by creating a real-time (200 millisecond latency) gateway between a cordless telephone (49 MHz, FM 15 kHz

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<sup>1</sup> First Report and Order and Third Notice of Proposed Rulemaking, WT Docket No. 96-86, FCC 98-191 (Released September 29, 1998).

channel) and a CB radio (26 MHz, AM, 10kHz channel) without modifying the telephone or the radio. My interest in the NPRM as an entrepreneur arises from the fact that I recently formed a corporation with the intent of pursuing the commercialization of technologies related to those invented as part of the SpectrumWare project.

Software radio is developing rapidly.<sup>3</sup> I estimate that software radio products that enable interoperation will be available within 18 months. These products initially will take the shape of base stations or similar units that may be deployed at the site of incidents where interoperation is needed or may serve as adjuncts to dispatch centers. These base stations will allow public safety officials to dynamically establish communication between radios using different portions of the spectrum, modulation, bandwidth and encryption.

As processor speeds increase and power requirements decrease over the next five to ten years, software radio products will be available in form factors appropriate for mobile and portable applications, supplanting hardware radios in all circumstances where interoperability is necessary. Portable and mobile software radios will allow direct interoperation between public safety officials in the field and will provide a spectrum efficient alternative to the creation of gateways using software radio base stations, which will require the use of a send and receive channel for each hardware radio for which the software radio is serving as a gateway.

### III. Difficulties Presented by Proprietary Systems

Proprietary systems represent a difficult issue. On the one hand, the development of advanced radio protocols and incorporation of those protocols into radio systems

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<sup>2</sup> See *infra* notes 4 and 5 and accompanying text.

should be encouraged by allowing inventors to reap the financial reward associated with their developments. Obviously, this promotes the social goal of technological innovation. Unfortunately, to the extent that these proprietary protocols inhibit interoperation, they frustrate the social goal of effective and efficient public safety radio communication.

The Commission recognized these competing interests in the NPRM with respect to proprietary technologies that may be incorporated into standards developed for the 700 MHz interoperability channels.<sup>4</sup> The situation we are addressing may be distinguished from the situation addressed by the NPRM in two respects. First, we are discussing technologies that have already been developed and integrated into products in addition to those that may become part of future products, therefore the ability to interoperate with legacy systems is significant. Second, we are discussing a comparatively minor level of usage (i.e., occasional usage of proprietary technology by a software radio for interoperability purposes only).

Three approaches to the issue seem possible. I believe the preferable approach is to require the manufacturer of any radio that incorporates proprietary protocols to license, without charge, the use of such proprietary protocols for the sole purpose establishing interoperation. This would ensure that software radios could be used to establish interoperation between proprietary systems and that the proprietary protocols could not be used for any other purpose without the consent of the relevant manufacturer.<sup>5</sup> An

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<sup>3</sup> See "Mission Need Statement (MNS) for the Joint Tactical Radio (JTR)," [http://www.dtic.mil/jcs/j6/mns\\_21aug.html](http://www.dtic.mil/jcs/j6/mns_21aug.html).

<sup>4</sup> See NPRM ¶ 122 ("[N]o proprietary data is to be incorporated in any standard ultimately recommended unless the proprietary data is made available on a fair, reasonable, unbiased and non-discriminatory basis, with license fees approved by ANSI and on terms and conditions set by that standards body.")

<sup>5</sup> I am not proposing that the user of a software radio using proprietary technologies other than in interoperation situations should be able to avoid paying for the right to use those

alternative approach would be to require radios that operate using proprietary protocols to be capable of disabling those technologies when interoperating with radios that do not also use such technologies. The problem with this approach is that it does not address interoperation with proprietary systems that already have been installed. Finally, public safety officials seeking interoperability might seek to license for a fee the right to interoperate with any radio using any proprietary technology. The unfortunate side effect of the latter approach is that it either raises the cost of all radios that can interoperate with proprietary systems or it frustrates the purpose of the licensing scheme by leaving some public safety radios unable to interoperate with proprietary systems.

#### IV. Conclusion.

The Commission can ensure interoperation across the entire spectrum used by public safety agencies by requiring radio manufacturers to license proprietary technologies for the limited and important purpose of interoperation. The damage to interests of the manufacturers of the proprietary systems caused by such an approach would be negligible, and the benefits to public safety agencies would be significant.

I recognize that the above comments may well exceed the scope of the comments solicited by the Commission in connection with interoperation in general and, perhaps most significantly, interoperation in the bands below 512 MHz. However, software radio technology is advancing rapidly and I believe the Commission should be alerted both as to its progress and as to its implications. For example, a software radio could establish a wideband communication path by simultaneously using multiple discontinuous narrow channels. Two advantages of such an approach are that channel use would be more

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technologies. No social goals would be served by allowing software radio users to appropriate proprietary technology for non-interoperation uses.

efficient, since there would be no need to set aside a contiguous block of spectrum for wideband communications, and that adjacent channel interference would be diminished, since the division of a wideband signal into multiple narrower bands can mitigate the adjacent channel interference associated with many wideband systems. If representatives of the Commission would like to discuss these matters further, I would be most happy to oblige.

Sincerely,

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